PROGRESS REPORT 4/15/61 - 5/15/61
CONTRACT NO. AF 33(600)40280

SYSTEM

SCHEDULE PROGRESS

MAJOR UNIT	DUE THIS MONTH	COMMENT
Control	Release dwgs from drftg	Dwgs released on schedule.
Power Supply	Release dwg from dftg.	Dwgs delayed to 6/26. Not expected to affect final delivery.
Frame Assembly	Continue layout	Layout continuing
Navigation Tie-In	Complete drawings	Dwgs. complete except top assembly, partial release, no delay anticipated.
Synchronizer	Complete drawings	Synchronizer drawings complete and released, frequency generator drawings delayed. Reschedule complete 6/19. No delay anticipated in first unit.
Antenna	Complete release	All drawings released, some behind schedule. No delay anticipated in first unit.
Modulator	Release drawings	Drawings released on schedule.
Duplexer	P.O. completed Switch driver started in Drafting. Switch bread-board.	In difficulty - See detail in report
Receiver	Drawings complete	Major subassemblies complete with some releases. Top assembly completed 6/10. No delay anticipated in first unit.
Recorder	Video Amp. drawings complete	Video amp dwgs held pending introduction of change in AGC. Anticipated complete 6/2. No delay is expected in first unit.

SECRET

 enclosure.

Means to provide auxiliary flight data have been determined and quoted upon. Contracts have not yet been signed however.

A proposal and quotation for flight test of this equipment in an F101 which would be based at this location was begun.

CONTROL PANEL

All drawings for the Control Panel have been released to the shop.

POWER SUPPLY

The control panel was released from drafting on 5/15/61.

Drafting started work on the power supply on 5/1/61 and is expected to be finished on 6/12/61.

Information was given to the components section on 5/10/61 for the +5000 V supply. The temperature range for the +5000 V supply was changed from the 0°C to 49°C, to 0°C to 85°C.

FRAME ASSEMBLY

The layout of the frame assembly is continuing, reflecting the changes in installation requirements and mounting requirements of the major components. Drawings are scheduled for release to the shop June 30.

NAVIGATION TIE IN

Drift Speed Unit

A breadboard gear box on which a geared servomotor, synchro resolver and precision potentiometer has been mounted has been completed. A more elaborate setup for testing the angular accuracy of this drift angle information unit is being built.

The servomotor-gear box-resolver-pot assembly proposed by Bowmar Instrument Corporation has been accepted and will be used in the drift angle unit. A purchase part drawing for this unit has been completed.

A step motor-control rectifier switch hook up for the ground speed information unit has been checked out. An effort is being made to determine the minimum power voltage required by the step motor, because it has been determined that these motors need additional cooling if this voltage is at a previously specified level.

A step motor-gearhead-pot has been shipped by Bowmar Instrument Corporation.

Both the drift angle and ground speed information units are ready for release to the shop.

The accelerometer-drift speed summing amplifier has been designed. Layout in drafting has been completed. Layout of the accelerometer amplifier-power supply has been completed. The detailing of this chassis is nearly completed.

Accelerometer

Accelerometers for three systems and one spare have been ordered. Delivery is expected approximately July 5, 1961.

Frequency responses of the breadboard accelerometer circuits were run under several conditions. Room temperature responses were obtained with and without the integrator. These tests indicated that circuit performance conformed to the designed performance in general. However, it is noted that even allowing for low measurement accuracy, the phase shift at higher frequencies is more than expected. The cause for this may be lower gain than expected or it may be a fixed measurement error which went undetected. The analysis of these results and possible corrections are proceeding. The tests will be conducted again when the cause of the excessive phase shift is determined.

The circuit without the integrator was also tested at 150°F. The curve under this condition is not appreciably different from the room temperature curve, indicating that the operating temperature environment will not affect circuit performance.

SYNCHRONIZER

Frequency-Generator

The variable-frequency oscillator section was tested with the receiver and two difficulties appeared when the two were operated together. Firstly, a strong 30 mc sideband was noticed on the 120 mc output of the variable-frequency oscillator section and secondly, the power output of the variable-frequency section appeared to be too large. The variable-frequency oscillator section was reworked to eliminate one stage; the Buffer stage following the L-C oscillator was eliminated in order to reduce the power output by 44%. The stages were retuned to reduce the 30 mc component in the output to approximately 30 db down. These changes seemed to produce a satisfactory unit. Later tests indicated, however, that the receiver cannot tolerate as much of the 30 mc component as is now produced and that the 30 mc component should be closer to 52 db down. The output pi-matching filter will therefore be redesigned to increase the Q by a factor of ten and new tests will be made.

On the fixed-frequency oscillator section, effort has been concentrated on simplifying the circuitry and suppressing parasitic oscillations. The center-tapped push-push type of plate inductors have been removed and single-tuned plate inductors substituted. These changes were successfully made and the multiplying circuitry is now finalized up to the gated output stage. It is anticipated that the design of this section of the Frequency-Generator will be completed this week.

Work on the IF section will be resumed this week. The problem here is to obtain the proper limiting action by means of rather large driving voltages and still avoid oscillations. Final testing cannot be properly made until all other units are finalized. Some further testing however, can be done when Oscillator-Discriminator breadboard is received from Bulova some time this week.

Synchronizer-Generator

No problems - drawings have all been released and Model Shop is building.

ANTENNA

Electrical

Final verification of the power divider transitions is near completion. An electrical specification for the power divider assemblies has been prepared for verification of the subcontractor's manufacturing techniques.

The array stick design was revised first to eliminate the image lobe and second to center the design frequency. At present, the frequency centering needs a small correction and although the beam shaping is good, the depression angle will have to be corrected.

Mechanical

The honeycomb beam was released to the Model Shop and a purchase order placed with [redacted], Chula Vista, California.

STAT

The manifold assembly was released to the Model Shop and a purchase order placed with Gar Precision Products, Stamford, Conn. At the suggestion of the supplier a change of configuration was made which resulted in a substantial cost reduction. The radome mounting brackets were removed at this same time.

The array stick, array stick assembly and module assembly drawings were released to the Model Shop on 12 May 1961. Purchase orders are being written for the purchased items.

The Power Divider and Input Waveguide drawings were released to the Model Shop on 10 May 1961.

The high temperature tensile tests show that the electroformed nickel will have a tensile yield strength of 37,000 psi.

Efforts are continuing to improve the array stick seal bonding technique and to prevent the adhesive from protruding into the slots.

Tests are being conducted to find a satisfactory "O" ring for use in the power divider flanges. Most of the "O" ring manufacturers have been contacted and are sending samples of recommended "O" rings for our tests.

The dummy load drawing has been released to the Model Shop, the purchase order written and placed and delivery is expected shortly.

Drafting is complete with exception of an outline drawing, a shipping panel sketch and the correction of the top assembly drawing.

Work on the wooden mockup has been stopped due to the numerous changes. Work will be resumed after the release of the top assembly drawing. The mockup is approximately 75% complete.

MODULATOR

All drawings were completed on schedule.

The Model Shop is progressing satisfactorily with sheet metal fabrication and materials ordering.

The breadboard modulator was assembled with the high voltage pulse components placed in about the same configuration as in the final units. The capacitance load on the pulse transformer was measured and found to be 22 mmfd. The modulator was then taken to Burmac and the 7.5 KV supply, charging choke and PFN-pulse transformer installed. The PFN-pulse transformer case was open so that adjustments could be made. Burmac had been using a load capacity of 15 mmfd. When operating with the modulator, difficulty was encountered with ringing when the rise time was reduced to 0.1 microsecond. It was found to be necessary to remove the despiking choke to achieve better than 0.2 microsecond rise time. The pulse rise time and pulse flatness spec can be relaxed if necessary. It appears that Burmac can meet a pulse spec that is adequate. They have achieved a pulse rise time of 0.15 microsecond and a pulse flatness of 2% with the PFN-pulse transformer open. The unit will be closed and tests made to determine if the pulse is still satisfactory.

DUPLEXER

Airtron has begun work and is about one-half complete, on a square cross-section resonant ring development. Fixed price quote for 1 unit to Westinghouse is $6,000 each, 90 day delivery.

Investigation of filter (tank) type resonator is continuing; present indications are that a resonator of this type is quite feasible - switches to hold-off 500 KW in a single switch for this type of resonator still presents a problem.

Final tests on an automatic peak power monitor are being run, including temperature tests.

[redacted] and Westinghouse have agreed that Microwave Development Lab will be approached to build a traveling wave resonator in standard or double height large X-band guide to physically fit in Westinghouse's space requirements. Westinghouse will also request quotes on the square cross section ring so that orders may be placed for additional unit quickly when it is required to do so. 25X1

The switch driver electrical design has been completed. It is capable of 5 KV, 22 nanosecond pulses. Drafting is now beginning layout of this unit.

Tests were continued using a D.C. magnetic field to control breakdown of the gas when r.f. was applied. A special solenoid capable of supplying 3000 gauss was built for these tests. Control of the breakdown time was obtained over a range of 0.027 microseconds to 0.5 microseconds with a breakdown time of less than 10 nanoseconds. The tests were performed with an input power of 50 KW.

A new tube has been built and further tests will be made. The microwave circuit has been modified so that recovery time can be observed. Continuation of the tests were held up while another type of tube was tested. These tests are reported on below.

A Sylvania type SW-4199 tube in which a grid controls the discharge as in a thyratron was tested. The tubes were tested to see what sort of breakdown times could be achieved and how much control could be obtained within the pulse width of the incident r.f. as a function of pressure and level of incident r.f. power. It was found that control could be maintained only up to the first 0.3 of a microsecond of the r.f. pulse with the breakdown time being 10 nanoseconds. After 0.3 of a microsecond, control was lost. This was observed for power levels between 30 and 70 KW. On the basis of the data taken, it is concluded that this type tube is not suitable for AN/APQ-93 usages.

RECEIVER

TWT

A breadboard model of the TWT power supply is expected to be available next week. Testing will then be done with the TWT to insure proper operation with the supply.

IF and Video Amplifiers

The I.F. amplifier has been tested and is 100% complete.

The video amplifier has been tested. A gain adjustment will be added to initially set the video amplifier gain. Also a failure indication circuit will be incorporated.

The synchronous detector has been tested and is complete except for determination of resistance values in an isolation pad between the variable frequency oscillator input and the synchronous detector tubes. These

values will be determined when a working breadboard model of the variable frequency oscillator is available.

The I.F. amplifier, synchronous detector, and video amplifier have been cascaded and testing is now in progress on this combination.

Receiver and Stalo Assembly

Modification drawings of the phase detector of the microwave oscillator are completed. Layout of the receiver RF assembly is nearly completed. A relay to turn on the high voltages used by the microwave oscillator is being installed on the receiver frame. An overall receiver schematic has been completed.

The delivery of a Bomarc microwave oscillator from the shop has been delayed but may be here by 5/19/61.

A second VA-401 klystron amplifier has been received and checked out. At the expected operating level, supply voltage of 850-1000 volts is needed to obtain maximum gain which is 30 db. At 800 volts, the gain decreased by 1.5 db.

RECORDER

During the month of April, several of the major mechanical sub-assemblies were released fro fabrication. Packaging of the electronic equipment continues with some subassemblies in this area to be released for detailing early in the next month.

Fiber optic array and the Cathode Ray Tube deliveries are still a problem in respect to an October 1 delivery schedule for the first recorder.

Mechanical

The following assemblies were released for fabrication: the cathode ray tube assembly, film loop drive assembly, film-driven viscous drag roller assembly, film reel and capstan drive assembly and the structural plates. During the month we completed the design layouts for the auxiliary data projection system, film motion detector, and the film footage sensor layout. All of the latter have been released for detailing.

A study layout showing the revised shock mounts was submitted to Westinghouse for approval. The shocks are mounted to a frame which supports the recorder through a plane containing the center of gravity. The layout also shows the proposed mounting of the video amplifier. This drawing also serves to establish the overall dimensions of the recorder skin and the design of the frame for supporting the recorder. It has been agreed that the weight of the support frame and the shock absorbers will not be included in the overall weight of the recorder specification.

We have begun the design of the skin based on the information in the above layout.

The film loop sensors which are to control the loop size will be micro-switches rather than infra-red lamps and photocells.

Electronic

The major effort during the report period in the electronic area has been in the design of the electronic package. At the end of the month, we have reached a point in the package design where we are able to release drawings for detailing of components. We have also stepped up our ordering of those parts with long lead time delivery.

A device to detect and signal the performance of the film motion through the exposure station has been breadboarded and tested. It uses a reluctance pickup to sense the motion of gear teeth (which will be mounted on a film driven roller in the recorder). The resulting signal is amplified and rectified to operate a relay. The failure of film to drive the roller will be signaled by the disappearance of the signal which will close the relay contact to signal a malfunction.

Advance information indicates the need for a protective circuit to prevent high transient voltages from destroying the cathode ray tube. This can be accomplished by placing a 500 volt regulating tube (Coroton) from the screen grid to ground to bypass the transient current. We are awaiting further information on this requirement from Westinghouse, Elmira, in order to determine the extent of this design change.

Optical and Photographic

Our tests of various lubricants that can be applied to the film emulsion to reduce the friction of the film as it passes over the exposure station have not turned up any process that will significantly improve the situation. We are procuring a Teflon treated glass rod to determine the characteristics of this treatment in this respect.

Westinghouse informed us that procurement of film type SO 132 has been delayed since the film supplier has experienced difficulty in producing this type. It was agreed that Westinghouse would procure film type SO 243 which will sufficie for testing purposes, although this essentially halves the operation time of the recorder due to the thicker base of SO 243.

Experiment have been made with an outside vendor in testing various plastics for use in encapsulating the fiber array. The use of foaming plastic appears to be feasible.

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